1. About the data set

Site name (AsiaFlux three letter code)	Fujiyoshida forest meteorology research site (FJY)	
Period of registered data	From January 1,2010 to December 31, 2010	
This document file name	FJY_2010_001a.pdf	
Corresponding data file name	FJY_2010_001.csv	
Revision information		
Date	Details of revision	Renewed file name
27 April 2017	First registration	FJY_2010_001.csv FJY_2010_001a.pdf
Contact person#1	[Flux & Meteorology] Satoru Takanashi (tnsatoru@affrc.go.jp)	
Contact person#2	[Flux & Meteorology] Takafumi Miyama (tmiyama@affrc.go.jp)	
Data provider	Yuichiro Nakai	

2. Site description

Hour line (Time difference from UTC)	Japan Standard Time(JST) (9 hours ahead of UTC)
Location (address)	Kenmarubi, Kamiyoshida, Fujiyoshida 403-0005, Yamanashi, Japan (on the premises of Yamanashi Institute of Environment Science)
Position	35.45454N, 138.76225E (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Elevation	1030m above sea level (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Terrain type	Gentle slope
Slope	3.5 degrees
Area	36km^2
Fetch	150-3000m
Climate	Cool temperate (Köeppen climate classification: Cfb)
Mean annual air temperature	9.5 degreeC ,2000-2008 (Mizoguchi *et.al.*, 2011)
Mean annual precipitation	1955 mm, 2000-2007 (Mizoguchi *et.al.*, 2011)
Vegetation Type	Secondary natural evergreen needle-leaf forest
Dominant Species (Overstory)	Japanese red pine (*Pinus densiflora*)
Dominant Species (Understory)	Longstalk holly (*Ilex pedunculosa*)
Canopy height	Approx. 19m (measurement date: Apr. 2000)
Breast high diameter	23.5cm: japanese red pine (Otsuka *et.al.* 2003)
Age	approx. 90years: japanese red pine (Otsuka *et.al.* 2003)
LAI	Max. 5.0 m^{2}m^{-2}
Soil Type	Immature (litter and organic matter with partially exposed volcanic lava) Im
Other information	Highly disturbed until 90 years ago (Otsuka *et.al.*, 2003)

References

OTSUKA Toshiyuki, GOTO Takehiro, SUGITA Mikio, NAKAJIMA Takafumi, IKEGUCHI Hitoshi (2003) The origin of pine forest on Ken-marubi lava flow on the lower slopes of Mt.Fuji. Vegetation Science, 20:43-54 (in Japanese with English abstract)

MIZOGUCHI Yasuko, OHATNI Yoshikazu, NAKAI Yuichiro, IWATA Hiroki, TAKANASHI Satoru,, YASUDA Yukio, NAKANO Takashi, YASUDA Taisuke, WATANABE Tsutomu (2011) Climatic characteristics of the Fujiyoshida forest meteorology research site. Mount Fuji Research, 5:1-6.

3. Registered data

Observation items	Symbol	Unit	Height(s) Depth(s)	Instruments	Note
Date	DATE	-	****	****	yyyymmdd
Time	TIME	-	****	****	hhmm
Precipitation	PPT	mm	1.5m	B071-00 (YOKOGAWA)	(Mizoguchi *et al*., 2011)
Air temperature	Ta	degrees C	22.7m	HMP45D (VAISALA)	
Relative humidity	Rh	%	22.7m	HMP45D (VAISALA)	
Wind speed	U	$m \cdot s^{-1}$	27.2m	DA600-3T (KAIJO)	
Wind direction	WD	degrees	27.2m	DA600-3T (KAIJO)	
Global solar radiation (incoming / downward)	Sd	$W \cdot m^{-2}$	32.0m	CM6F (Kipp & Zonen)	See Note [3] (Mizoguchi *et al*., 2011)
Reflected solar radiation (upward)	Su	$W \cdot m^{-2}$	28.6m	[from the initiation to 2011-08-30] CM6B (Kipp & Zonen) [from 2011-08-30 to 2012-06-05] PCM03 (Prede) [from 2012-06-05 to the present] CMP6 (Kipp & Zonen)	See Note [3]
Photosynthetic active photon flux density (downward)	Pd	$micromol \cdot m^{-2} \cdot s^{-1}$	32.0m	LI190 (LI-COR)	See Note [3] (Mizoguchi *et al*., 2012)
Reflected PAR (upward)	Pu	$micromol \cdot m^{-2} \cdot s^{-1}$	28.6m	LI190 (LI-COR)	See Note [3],[5]
Net radiation	Rn	$W \cdot m^{-2}$	32.0m / 28.6m	CM6F, CM6B (Kipp & Zonen), PIR (Eppley)	See Note [4]
Soil heat flux	G	$W \cdot m^{-2}$	-0.02m	MF-81 (EKO)	
Sensible heat flux	H	$W \cdot m^{-2}$	27.2m	DA600-3T (KAIJO)	See Section 4
Latent heat flux	lE	$W \cdot m^{-2}$	27.2m	LI-7500 (LI-COR)	See Section 4
Friction velocity	Ust	$m \cdot s^{-1}$	27.2m	DA600-3T (KAIJO)	See Section 4
CO_2 flux	Fc	$micromol \cdot m^{-2} \cdot s^{-1}$	27.2m	LI-6262 (LI-COR)	Closed-path system See Section 4 (Ohtani *et al.*, 2005, Mizoguchi *et al*., 2012)

Storage change in canopy air layer	Sc	micromol・m^{-2}・s^{-1}	[from the initiation to 2010-07-08] 22.7, 18.9, 13.2, 9.4, 3.2m [from 2010-07-08 to the present] 26.5, 22.7, 18.9, 13.2, 9.4, 1.9m	LI-6262 (LI-COR)	See Section 4 (Ohtani *et al.,* 2005, Mizoguchi *et al*., 2012)
Net ecosystem exchange	NEE	micromol・m^{-2}・s^{-1}			Ust screening (Ust >= 0.12), Gap filled
Ecosystem respiration	Re	micromol・m^{-2}・s^{-1}			Gap filled
Gross primary production	GPP	micromol・m^{-2}・s^{-1}			GPP=-NEE+Re

Note

[2] snow cover influence is eliminated.
[3] value in night time is replaced by 0.0.
[4] Rn = Sd – Su + Ld - Lu (Ld: downward longwave radiation, Lu: upward longwave radiation)
[5] instrumental error is corrected

Gap filling

NEE	$-F_{NEE,day} = \frac{\emptyset \cdot Pd + (-F_{NEE})_{sat} - \sqrt{(\emptyset \cdot Pd + (-F_{NEE})_{sat})^2 - 4 \cdot \emptyset \cdot Pd \cdot \theta \cdot (-F_{NEE})_{sat}}}{2 \cdot \theta} + Re$ Parameters were derived daily, using the 15-day moving window.
Re	$F_{NEE,night} = F_{Ta=25℃} \times exp\left(Ha \frac{(Ta+273) - 298.0}{298.0 \times 8.31 \times (Ta+273)}\right)$ Parameters were derived daily using the 15-day moving window.

References

Ohtani, Y., Mizoguchi, Y., Watanabe, T., Yasuda, Y. (2005) Parameterization of NEP for gap-filling in a cool-temperate coniferous forest in Fujiyoshida, Japan. Journal of Agricultural Meteorology, 60(5): 769-772

MIZOGUCHI Yasuko, OHATNI Yoshikazu, NAKAI Yuichiro, IWATA Hiroki, TAKANASHI Satoru,, YASUDA Yukio, NAKANO Takashi, YASUDA Taisuke, WATANABE Tsutomu (2011) Climatic characteristics of the Fujiyoshida forest meteorology research site. Mount Fuji Research, 5:1-6.

MIZOGUCHI Yasuko, OHTANI Yoshikazu, YASUDA Yukio, TAKANASHI Satoru, NAKAI Yuichiro, IWATA Hiroki (2012) Seasonal and interannual variation in net ecosystem production of an evergreen needleleaf forest, Japan. Journal of Forest Research, 17(3):283-295

Data format

Data consists of fixed length (8 digits) comma separated format. Missing data is labeled as “ -9999.0” or "-9999.00".

Line 1: Symbol (Date, Time, PPT, Ta, …..)

Line 2: Unit (yyyymmdd, hhmm, mm, degC, ….)

"hhmm" shows intermediate time of averaging period.

i.e. "1215" labels half-hourly average (or sum) of data from 12:00 to 12:30

Line 3: Comment

Line 4: Data

:

Data example

```
    Date, Time,      PPT,       Ta,       Rh,        U,       WD,       Sd,       Su,       Pd,       Pu, ...........
yyyymmdd, hhmm,       mm,     degC,        %,     ms-1,      deg,     Wm-2,     Wm-2,    (*1),     (*1), ...........
File= KWG_2000_001.CSV; Created: 20100326; Gap= -9999.0; (*1): micro-mol m-2 s-1                         ...........
20000101, 0015,      0.0,     3.34,    87.19,     1.58,  -9999.0,      0.1,  -9999.0,      0.1,      0.0, ...........
20000101, 0045,      0.0,     3.12,    88.14,     1.44,  -9999.0,      0.0,  -9999.0,      0.1,      0.0, ...........
20000101, 0115,      0.0,     2.36,    90.51,     1.15,  -9999.0,     -0.3,  -9999.0,      0.1,      0.0, ...........
20000101, 0145,      0.0,     2.14,    91.32,     0.83,  -9999.0,      0.0,  -9999.0,      0.1,      0.0, ...........
20000101, 0215,      0.0,     2.28,    88.96,     0.49,  -9999.0,     -0.3,  -9999.0,      0.1,      0.0, ...........
20000101, 0245,      0.0,     2.24,    89.82,     0.35,  -9999.0,     -0.2,  -9999.0,      0.2,      0.0, ...........
20000101, 0315,      0.0,     2.05,    89.49,     1.50,  -9999.0,      0.1,  -9999.0,      0.2,     -0.1, ...........
20000101, 0345,      0.0,     2.41,    87.25,     1.27,  -9999.0,      0.0,  -9999.0,      0.2,      0.0, ...........
20000101, 0415,      0.0,     2.31,    86.83,     1.12,  -9999.0,     -0.2,  -9999.0,      0.1,      0.0, ...........
20000101, 0445,      0.0,     2.84,    83.36,     0.54,  -9999.0,     -0.6,  -9999.0,      0.0,      0.0, ...........
20000101, 0515,      0.0,     2.53,    83.32,     1.23,  -9999.0,      0.2,  -9999.0,      0.2,      0.0, ...........
20000101, 0545,      0.0,     1.59,    87.54,     1.29,  -9999.0,     -0.6,  -9999.0,      0.0,      0.0, ...........
20000101, 0615,      0.0,     1.89,    85.13,     0.94,  -9999.0,      0.4,  -9999.0,      0.3,      0.0, ...........
20000101, 0645,      0.0,     1.77,    82.40,     0.83,  -9999.0,      3.5,  -9999.0,      8.5,      0.4, ...........
20000101, 0715,      0.0,     2.67,    76.83,     1.38,  -9999.0,     45.8,  -9999.0,     71.9,     11.6, ...........
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
    .        .        .         .        .         .         .         .         .         .         .
```

4. Observation and calculation

4-1. Flux observation system and data acquisition

Type of sonic anemometer	DA600-3T (Probe TR-61C) (KAIJO)
Type of IRGA	LI-6262, LI-COR
Sampling rate	5Hz (from the initiation to 2010-05-18), 10Hz (from 2010-05-18 to the present)
Averaging time	30min
Flux measurement height #1	27.2m
Zero-plane displacement	
Roughness length	
Calibration information	CO_2/H_2O gas analyzer was calibrated once a day by flowing standard gases that were automatically controlled.
Other information	

4-2. Flux calculation

Calculation methods		Note
Flow attenuation [*4-6]	Not applied	
Coordinate rotation [*1-3]	Applied	double rotation
Lag removal [*2, 7, 8]	Applied	automatic

4-3. Flux corrections

Correction methods		Target flux	Note
Cross wind correction[*9, 10]		sensible heat flux (H), latent head flux (lE)	
Vapor correction		sensible heat flux (H)	
High frequency loss	Band-pass covariance method [*12]	CO_2 flux (Fc)	
	Experimental approach [*2]		
Low frequency loss (Detrending)	Linear detrend [*16]	sensible heat flux (H), latent head flux (lE), friction velocity (Ust), CO_2 flux (Fc)	
WPL Correction[*17-21]		latent head flux (lE), CO_2 flux (Fc)	
Others [*22-24]	Temperature dependency for latent heat Humidity dependency for specific heat Temperature dependency for air density Pressure dependency for air density		

4-4. Quality control [*25-26]

QC methods				Note
Raw data test [*25,26]	Spike test [*27]		Applied	
	Absolute limits		Applied	
	Absolute variance		Applied	
	Higher-moment statistics	skewness	Applied	
		kurtosis	Applied	
	Discontinuities	Harr mean test	Applied	
		Harr variance test	Applied	
	Visual inspection		Applied	
Non steady state test [*25]			Not applied	
Absolute thresholds			Not applied	
Others			Data with |Ψ| > 5deg is eliminated	

4-5. Storage term

Target storage		Note
CO_2	[from the initiation to 2010-07-08] CO_2 profile data (22.7, 18.9, 13.2, 9.4, 3.2m) Sampling interval: 5 minute at each height [from 2010-07-08 to the present] CO_2 profile data (26.5, 22.7, 18.9, 13.2, 9.4, 1.9m) Sampling interval: 1 minute at each heigh	(Ohtani *et al*., 2005, Mizoguchi *et al*., 2012)

References

Ohtani, Y., Mizoguchi, Y., Watanabe, T., Yasuda, Y. (2005) Parameterization of NEP for gap-filling in a cool-temperate coniferous forest in Fujiyoshida, Japan. Journal of Agricultural Meteorology, 60(5): 769-772

MIZOGUCHI Yasuko, OHTANI Yoshikazu, YASUDA Yukio, TAKANASHI Satoru, NAKAI Yuichiro, IWATA Hiroki (2012) Seasonal and interannual variation in net ecosystem production of an evergreen needleleaf forest, Japan. Journal of Forest Research, 17(3):283-295

5. Important events

Date	Events

6. Publications relating to this site

OHTANI Yoshikazu, MIZOGUCHI Yasuko, WATANABE Tsutomu, YASUDA Yukio (2005): Parameterization of NEP for gap filling in a cool-temperate coniferous forest in Fujiyoshida, Japan. Journal of Agricultural Meteorology, 60(5):769-772

OHTANI Yoshikazu, SAIGUSA Nobuko, YAMAMOTO Susumu, MIZOGUCHI Yasuko, WATANABE Tsutomu, YASUDA Yukio, MURAYAMA Shohei (2005): Characteristics of CO_2 fluxes in cool-temperate coniferous and deciduous broadleaf forests in Japan. Phyton, 45(4):73-80

ICHII Kazuhito, SUZUKI Takashi, KATO Tomomichi, ITO Akihiko, HAJIMA Tomohiro, UEYAMA Masahito, SASAI Takahiro, HIRATA Ryuichi, SAIGUSA Nobuko, OHTANI Yoshikazu, TAKAGI Kentaro (2010): Multi-model analysis of terrestrial carbon cycles in Japan: limitations and implications of model calibration using eddy flux observations. Biogeosciences, 7:2061-2080.

MIZOGUCHI Yasuko, OHTANI Yoshikazu, NAKAI Yuichiro, IWATA Hiroki, TAKANASHI Satoru,, YASUDA Yukio, NAKANO Takashi, YASUDA Taisuke, WATANABE Tsutomu (2011) Climatic characteristics of the Fujiyoshida forest meteorology research site. Mount Fuji Research, 5:1-6.

MIZOGUCHI Yasuko, OHTANI Yoshikazu, TAKANASHI Satoru IWATA Hiroki, YASUDA Yukio, NAKAI Yuichiro, (2012) Seasonal and interannual variations in net ecosystem production of an evergreen needleleaf forest in Japan. Journal of Forest Research, 17(3):283-295

THANYAPRANEEDKUL Juthasinee, MURAMATSU Kanako, DAIGO Motomasa, FURUMI Shinobu, SOYAMA Noriko, NASAHARA N. Kenlo, MURAOKA Hiroyuki, NODA M. Hibiki, NAGAI Shin, MAEDA Takahisa, MANO Masayoshi, MIZOGUCHI Yasuko (2012): A Vegetation Index to Estimate Terrestrial Gross Primary 7 Production Capacity for the GCOM-C/SGLI Satellite Sensor. Remote Sensing 4(12): 3689-3720.

KONDO Masayuki, ICHII Kazuhito, UEYAMA Masahito, MIZOGUCHI Yasuko, HIRATA Ryuichi, SAIGUSA Nobuko (2013): The role of carbon flux and biometric observations in constraining a terrestrial ecosystem model: a case study in disturbed forests in East Asia. Ecological Research 28(5): 893-905.

SAIGUSA Nobuko, LI Cheng-Gong, KWON Hyojung, TAKAGI Kentaro, ZHANG Lei-Ming, IDE Reiko, UEYAMA Masahito, ASANUMA Jun, CHOI Young-Jean, CHUN Jung Hwa, HAN Shi-Jie, HIRANO Takashi, HIRATA Ryuichi, KANG Minseok, KATO Tomomichi, KIM Joon, LI Ying-Nian, MAEDA Takahisa, MIYATA Akira, MIZOGUCHI Yasuko, MURAYAMA Shohei, NAKAI Yuichiro, OHTA Takeshi, SAITOH Taku M., WANG Hui-Ming, YU Gui-Rui, ZHANG Yi-Ping, ZHAO Feng-Hua (2013): Dataset of CarboEastAsia and uncertainties in the CO2 budget evaluation caused by different data processing. Journal of Forest Research 18(1): 41-48.

MIZOGUCHI Yasuko, YASUDA Yukio, OHTANI Yoshikazu, WATANABE Tsutomu, KOMINAMI Yuji, YAMANOI Katsumi (2014): A practical model to estimate photosynthetically active radiation using general meteorological elements in a temperate humid area and comparison among models. Theoretical and Applied Climatology 115(3-4): 583-589.

MIYAMA Takafumi, MORISHITA Tomoaki, OKUMURA Motonori, MIYASHITA Shunichiro, TAKANASHI Satoru, YOSHIFUJI Natsuko (2016): Spatial Variations in α-Pinene Emissions from Soils in a Red Pine Forest. J. Jpn. Forest Society 98: 59—64 [in Japanese]

Publication list: http://www2.ffpri.affrc.go.jp/labs/flux/paper_e.html [FJY]

References cited

Flux calculation

*1 McMillen, R.T., 1988. Boundary-Layer Meteorology, 43: 231-245.

*2 Aubinet M. et al.,2000. Advances in Ecological Research, 30: 113-175.

*3 Wilczak. J.M., Oncley, S.P. and Stage, S.A., 2001. Boundary-Layer Meteorology, 99: 127-150.

*4 Wyngaard, J. C. and Zhang, S. F., 1985. J. Atmos. Oceanic Tech., 2: 548-558.

*5 Kaimal, J.C. et al., 1990. Boundary-Layer Meteorol., 53: 103-115.

*6 Shimizu, T. et al., 1999. Boundary-Layer Meteorol., 64: 227–236.

*7 Leuning, R. and Judd M.J., 1996.Global Change Biology, 2: 241-254.

*8 Information from Li-Cor

Flux correction

*9 Schotanus, P. et al., 1983. Boundary-Layer Meteorology, 26: 81-93.

*10 Liu, H., Peters, G. and Foken, T., 2001. Boundary-Layer Meteorology, 100: 459-468.

*11 Kaimal J.C. and Gaynor, J.E., 1991. Boundary-Layer Meteorology, 56: 401-410.

*12 Watanabe et al., 2000. Boundary-Layer meteorol. 96, 743-491.

*13 Massman, W. J., 2000. Agric. For. Meteorol. 104, 185-198

*14 Massman, W. J., 2001. Agric. For. Meteorol. 107, 247-251

*15 Moore, C.J., 1986. Boundary-Layer Meteorology, 37: 17-35.

*16 Moncrieff, J. et al., 2004. Averaging, detrending and filtering of eddy covariance time series. In: X. Lee (Editor), Handbook of Micrometeorology: A guide for surface Flux Measurements. Kluwer, Dirdrecht, pp. 7-31.

*17 Webb, E. K., Pearman, G.I. and Leuning, R., 1980. Quarterly Journal of the Royal Meteorological Society, 106: 85-100.

*18 Fuehrer, P.L. and Friehe, C.A., 2002. Boundary-Layer Meteorology, 102: 415-457.

*19 Liebethal, C. and Foken, T., 2003. Boundary-Layer Meteorology, 109: 99-106.

*20 Leuning, R. 2004. Measurements of trace gas fluxes in the atmosphere using eddy covariance: WPL corrections revisited. In: X. Lee (Editor), Handbook of Micrometeorology: A guide for surface Flux Measurements. Kluwer, Dirdrecht, pp. 119-132.

*21 Massman, W. 2004. Concerning the measurement of atmospheric tarce gas fluxes with open- and closed-path eddy covariance system: The WPL terms and spectral attenuation. In: X. Lee (Editor), Handbook of Micrometeorology: A guide for surface Flux Measurements. Kluwer, Dirdrecht, pp. 133-160.

*22 Fischer, G (Editor), 1988. Landolt-Börnstein, Numerical data and functional relationships in science and technology, Group V: Geophysics and space research, Volume 4: Meteorology Subvolume b: Physical and chemical properties of the air. Springer, Berlin, Heidelberg, 570pp.

*23 Stull, R.B., 1988. An Introduction to Boundary Layer meteorology. Kluwer Acad. Publ., Dordrecht, Boston, London, 666pp.

*24 Cohen, E. R. and Taylor, B. N., 1986. The 1986 adjustment of the fundamental physical constants. Internatinal Counsil of Scientific Unions (ICSU), Committee on Data for Science and Technology (CODATA). CODATA-Bulletin, No. 63: 36pp.

Quality control

*25 Vickers, D. and Mahrt, L., 1997. Journal of Atmospheric and Oceanic Technology, 14: 512-526.

*26 Foken, T. and Wichura, B., 1996. Agricultural and Forest Meteorology, 78: 83-105.

*27 Hojstrup, J., 1993. Measuring Science Technology, 4: 153-157.

*28 Schmid, H. P., 1994. Boundary-Layer Meteorology, 67: 293-318.

*29 Korman, R. and Meixner, F.X., 1990. . Boundary-Layer Meteorology, 99: 207-224.